INDIVIDUAL SPECIES IMPACT ASSESSMENTS: A STANDARDIZED TECHNIQUE FOR DESCRIBING THE IMPACT OF DEVELOPMENT PROPOSALS ON CRITICAL INVERTEBRATE SPECIES

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The British planning system furnishes several mechanisms by which important invertebrate sites can be identified and defended from development and certain other forms of damaging change of land-use. Site designation is perhaps the most fundamental of these mechanisms. It ensures that the best sites are flagged up as such at an early stage through notification as Sites of Special Scientific Interest (SSSI's) or as Non-Statutory (Second-tier) Wildlife Sites. Non-statutory sites are known variously by names such as Sites of Interest for Nature Conservation (SINC's), County Wildlife Sites, County Ecosites and so on. *Planning Policy Guidance for Nature Conservation (PPG 9)* published recently (DOE, 1994) instructs local planning authorities to identify such sites in their Development Plans (i.e. County Structure Plans, Local Plans and Unitary Development Plans—according to the type of local authority) and associated Proposals Maps, and to furnish policies that afford an appropriate degree of protection to these sites. This often suffices in dissuading developers from targeting such sites for their schemes.

However, planning applications are sometimes received for such designated sites, or for other important sites that are of sufficient quality for designation but have yet to go through the formal process of designation. Occasionally, local authorities are so desperate for inward investment opportunities that they double-designate sites both for their nature conservation importance and development potential. This is presumably with the intention of allowing the planning control system to sort out which of the two is the more important or finding a healthy compromise between the two competing interests.

Where development proposals affect internationally important sites and SSSI's, or are of a particular nature, or exceed a particular size, the production of an *Environmental Assessment* (formerly known as an Environmental Impact Assessment) is a legal requirement (English Nature, 1994). However, such Assessments, or more narrowly scoped *Environmental Appraisals*, are widely used beyond this on non-statutory sites by developers who are keen to be seen as environmentally responsible, and in areas where local planning authorities wish to treat nature conservation considerations rigorously (particularly the case where they employ in-house ecologists or work closely with their local Wildlife Trusts and statutory organizations such as English Nature).

These Assessments and Appraisals are formal processes that accompany planning applications to assist local planning authorities or DOE Planning Inspectors in reaching an informed planning decision. They usually address two issues:

- clarification or confirmation of a site's ecological importance if not already clearly established
- a prediction of the nature and magnitude of 'impact' likely to be associated with a development proposal.

Several hundred Assessments and Appraisals are produced nationally each year covering a wide variety of environmental subjects of which ecology is but one. Within the ecological part of such reports there is rarely a strict requirement for invertebrates to be considered, though this seems to be happening with greater frequency and the number of professional entomologists working as freelance consultants or as employees of large environmental consultancies is increasing. Consideration of invertebrates occurs most frequently at the site evaluation stage, when various options for the location of a development may be taking place, and at sites where the presence of unusual invertebrate assemblages is already established. Unfortunately, the quality of invertebrate information found in such Assessments and Appraisals varies greatly and can be inadequate in a number of respects:

- The adequacy of taxonomic coverage. Often only relatively popular and rapidly surveyed groups such as butterflies and dragonflies receive coverage, whilst other larger invertebrate groups with far greater potential for informing the environmental assessment process, such as flies, beetles, bugs, aculeate Hymenoptera and night-flying moths, are ignored.
- The adequacy of sampling. Fieldwork may be of insufficient regularity or duration, or data may rely entirely on archive information that is uneven in coverage and several years out of date. Fieldwork may have been undertaken at inappropriate times of the year, during poor weather, or using insufficiently skilled surveyors and inappropriate methodologies. There may be inconsistencies in approach where several different sites, or different parts of the same site, are being compared for their comparative importance.
- The quality of interpretation. There may be a lack of thoroughness in the way in which conclusions have been reached or even pure invention. There may be a lack of entomological or ecological expertise on the part of the surveyor (good entomologists are not necessarily good habitat ecologists!), or a lack of context, so that the information provided does not clearly answer fundamental questions such as 'how important is the site for invertebrates?', 'which parts of the site are most important for scarcer species and valuable assemblages?', 'what will be the scale and nature of the impact?' and 'what scope is there for ecological compensation or mitigation measures?'. Good quality information can also become distorted when it is summarized in non-technical summaries and other parts of an Environmental Assessment report (often by a different person to the one who carried out the entomological interpretation).
- The style of presentation. Poor presentation can result in difficulties in interpreting information. It commonly results from a lack of relevant detail, an excess of unnecessary detail, the use of an inappropriate format, inappropriate jargon, and again, a lack of context. The reluctance to use maps for showing the distribution of scarce or otherwise important species within a site is a particular criticism.

The consequence of these shortcomings is usually the publication of misleading statements that fail to accurately describe the importance of a site in invertebrate terms and fail to adequately describe and quantify the likely impact of a proposal. These may in turn result in over-optimistic statements that suggest that:

- The invertebrate interest of a large, diverse site can be concentrated into a much smaller area.

- The use of a vegetation-led approach (often involving the protection or translocation of vegetation types deemed most valuable by botanists) will always protect the more important invertebrate species and assemblages present at a site.
- Habitat translocation and habitat creation projects can be as successful and predictable for invertebrates as they are purported to be for plants.
- Insect populations are evenly distributed over a site and are unlikely to be affected by partial destruction of a site.

Suffice to say, such assumptions are often far from accurate. Large, varied sites tend to throw up many complex and subtle mosaics and transitions that are difficult to characterize, let alone recreate. Scarce species and unusual assemblages are often associated with vegetation types that are not considered exciting in botanical terms. Many rare phytophagous species are associated with surprisingly common plants, albeit sometimes under very specific circumstances, and sometimes these plants are very patchily distributed within a site. It is important not to over-simplify the requirements of invertebrates, whilst at the same time ensuring that important information is presented in an explicit and user-friendly format that can be readily understood by others involved in the Environmental Assessment process, such as the project manager and planning officers of the local planning authority.

Individual species impact assessments

Individual Species Impact Assessment forms (Fig. 1) were designed to provide a standardized technique that could overcome many of the problems described above. I have been influenced by my experiences as a professional local authority ecologist, an ecological consultant and a member of a wildlife trust Conservation Committee. I both vet Assessments and Appraisals and help to produce them. Individual Species Impact Assessments are double-sided sheets that can be used to demonstrate how scarce or otherwise important invertebrates might be utilizing a site and how they are likely to be impacted by a development proposal. They are designed for situations where a broad taxonomic spectrum of invertebrates is being considered and information is required specifically on the species that make a site special or unusual. A single sheet is used for each critical species. Reasonably experienced invertebrate workers should be able to produce them fairly easily following sufficiently detailed survey work.

The first page provides a map of the site showing the main habitat features and the extent of direct impact where this is only partial. Solid circles are used to show the precise location(s) at which the species was found at the site. Other symbols are then added to show the distribution of the species' habitat or other requirements. For some species, only a single symbol is required, perhaps denoting a food-plant (e.g. M for mugwort). For others with more complex biologies, several symbols might be required. A mining bee for example might require an N to show the distribution of suitable sandy nesting areas, and a variety of other symbols for the various forage plants e.g. S for sallow, B for blackthorn and H for hawthorn. The symbols are keyed out at the bottom of the page and zones of obvious potential impact can be shown with cross-hatching. On the second page, three boxes are provided to fill in information on the ecology/biology/requirements of a species, the likely impact of the development proposal and suggested mitigation measures and habitat management.

Such sheets can be produced for all the scarcer species present at a site (e.g. species classified as Red Data Book, Nationally Scarce or Regionally Scarce). This is

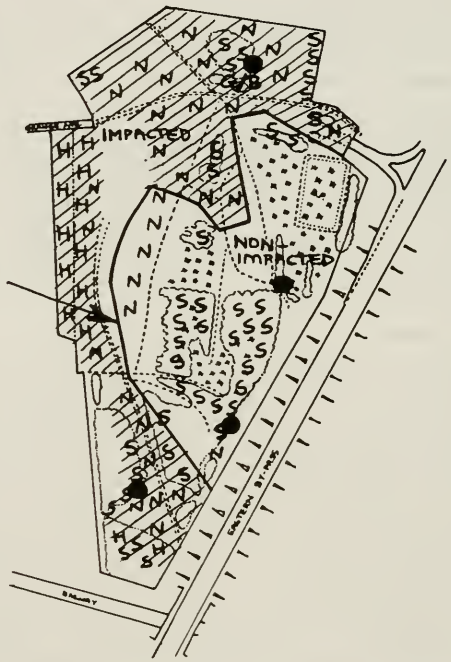
Individual Species Impact Assessment

Site:	HERALD WAY MARSH SSSI
Species:	ANDRENA TIBIALIS (A MINING BEE)
Author:	S. J. FALK

Coventry Museums & Galleries
Ecology Unit

Site Map

A moderately strong population Recorded:
15/4/87
16/4/87
6/4/90
11/4/94



KEY

Species **known** occurrence at site	●

Distribution of species requirements on site (specify and symbolise accordingly)

1. SALLOW - the main forage plant	S
2. HAWTHORN – subsidiary forage plant	H
3. BROOM / GORSE " " "	B/G
4. LIKELY NESTING AREAS (sparsely vegetated sandy areas)	N
Area of likely/certain impact (substantial impact predicted)	▨

City of Coventry

Fig. 1. An example of an Individual Species Impact Assessment form.

1. Brief summary of biology/ecology/requirements

A spring mining bee (typically March-May) occurring in a variety of feirly open habitats, including heathland, post-industrial sites, gardens and open woodland. Females obtain pollen from shrubs such as sallow, willow, blackthorn, cherry, maple/sycamore, hawthorn, gorse and broom. Sallow is especially favoured at this site.

Nesting occurs in sparsely-vegetated or short-cropped light soils exposed to the sun. The precise nesting areas at this site have not been identified

This is one of only 4 sites known for the bee in the vice-county of Warwickshire, and appears to be the strongest colony, with records for 4 seperate dates.

2. Likely impact of the proposed development

A substantial impact is predicted, resulting from the loss of most of the potential nesting areas; also a substantial reduction in the amount of spring-blossoming shrubs at the site. It is unclear if the bee will be able to survive following development.

3. Suggested mitigation measures and habitat management

Incorporate the planting of spring blossoming shrubs such as sallow, willow, hawthorn (see under 1) in any screening or boundery planting proposed for the development. Attempt to create new potential nesting areas such as grassy embankments within the remaining site eg. around drainage ponds, boundery features etc.

Fig. 1 *continued.*

generally the section of the invertebrate assemblage that is of most concern as it is these species that tend to contribute towards a site's designation as a SSSI or Non-statutory Wildlife Site. On reasonably well-recorded sites this will usually amount to somewhere in the region of 10–20 Impact Sheets. If you require more than this number you are probably dealing with an exceptional locality!

Assessing impact magnitude for each species

The sheets permit the likely impact of a development proposal to be assigned to each of the species. To date I have used three levels of magnitude plus a 'don't know' category as follows:

- Minimal Impact, where 30% or less of a species habitat or any of its individual requirements are threatened.
- Substantial Impact, where 70% or more of a species habitat or any of its individual requirements are threatened.
- Moderate Impact, for a species falling between the two above categories.
- Uncertain Impact, where a species' ecology, or the status of its requirements, are insufficiently understood.

Species falling into the Substantial Impact category can be reasonably viewed as being threatened with extinction at the site should the development proceed. Those that fall into the Minimal Impact category can be viewed as having good chances of survival. For species falling into the Moderate Impact category, perhaps the best that can be stated is that one cannot always be confident that they will survive the development. The thresholds defining these categories are somewhat subjective and there is no reason why different % demarcations should not be used. However, the following points should be considered when assigning impact magnitude:

- For species with two or more requirements at a site, the loss or severe depletion of any one of those requirements could result in their extinction. Good quantities of a larval development site will be of little consequence if the adults' food source has been removed.
- The initial size of a site and the variable tolerances of different species to a reduction of their requirements will need to be considered when deciding the appropriate % figure for defining the different impact magnitude categories. For very small sites a relatively small reduction in size could result in extinction. At a very large homogenous site there may be far greater leeway.
- Some species have highly specific requirements within a vegetation type. It is not always possible to be certain which part of a marsh is suitable for a particular wetland invertebrate. It may be the entire marsh or only a tiny part of it with a particular hydrological regime or vegetation community. The entire approach has to be pragmatic, though experienced invertebrate recorders are often surprisingly good at sensing the extent of suitable habitat for a particular species, particularly where they have encountered that species on several previous occasions. Fortunately the sheets are designed so that the opinions of the recorders can be qualified using the map on the first page and the boxes on the second, and these opinions can be easily questioned and corrected in the light of new information.
- The populations of some invertebrates may be utilizing features outside the formal boundaries of the site that is being considered. They may even be operating as metapopulations at the landscape level. In the latter instance the individual

populations forming the metapopulation may become non-viable where isolation from nearby colonies occurs. It is therefore crucial to be aware of the geographical context of your site in relation to other areas of the same or complementary habitats.

- Certain forms of impact can be indirect and easily overlooked. The loss of permeable ground surface through partial development of a site may precipitate the gradual drying out of a marsh some distance away. It is always advisable to read the draft sections of other parts of the Environmental Assessment report, or to talk to other specialists involved in the project, such as hydrologists or landscape architects, before forming a final decision. Indirect impact can be accounted for in the second box of the second page ('Likely impact of the proposed development') and by adding target notes to the map.
- Site development may be piecemeal, involving small successive incursions that individually might only have a moderate impact but collectively have a substantial one.

Following assignment of impact magnitude to the more important species, one can form an opinion on whether the overall development proposal is going to have a severe, moderate or minimal impact on the invertebrate interest of the site. This can be easily arrived at by checking the number of species that fall into the different impact magnitude categories, and checking the likely fate of the rarest species.

Where only partial development of a site is proposed and flexibility exists regarding the layout, the data you have gathered may help to identify the least damaging option. The data may also help in formulating a mitigation package to reduce the impact of the actual development where it proceeds (for example through sensitive landscaping), or a compensation package such as habitat re-creation or improved management of the surviving site or another site. The information can often have far greater use than simply providing ammunition for site defence. It can provide a mechanism for obtaining some conservation gain where development is inevitable.

The end result of the process

The final report usually consists of the following:

1. The aims of the survey and methodology employed, including mention of any constraints that might have affected the quality of the data (such as poor weather, insufficient recording, physical constraints etc). Map(s) showing the layout of the proposed development and the location of the main vegetation types or other important site features.
2. Discussion of the results of the survey accompanied by a full species list arranged in taxonomic order with the scarcer species annotated with their rarity category (usually within an appendix). A clear definition of the rarity categories provided as a further appendix.
3. A table showing potential impact magnitude on the scarce or otherwise important species and a summary of these results to highlight the degree of potential impact experienced by the different rarity categories, different site compartments (where used), or different vegetation types within the site.
4. A series of Individual Species Impact Assessment Sheets providing information on the important species and the nature and severity of potential impact (as a further appendix).

5. Discussion of the relative value of the site (where known) and the potential impact of the development on the overall invertebrate fauna (scarce and common species alike), by compartment or vegetation type where possible.
6. Advice on mitigation and compensation measures that can lessen the impact of a development or produce conservation gain to offset the losses that will be incurred through the development proceeding.
7. A brief non-technical summary describing the likely overall impact and opportunities for positive measures in a few sentences or paragraphs. The style of this summary should be designed so that it can be incorporated into the general non-technical summary serving the entire report with the minimum of modification. The project manager will usually clarify what is required. Remember that any rewording of your summary by a third person could lead to a distortion or watering down of your precious and often highly precise conclusions, so keep close control on how they are used. Membership of a professional body such as the Institute of Ecology and Environmental Management (IEEM) or Institute of Environmental Assessment (IEA), which have codes of professional conduct, can be very useful in enforcing your professional or learned opinion.

How much fieldwork is required?

This will depend on the size and nature of the site, the quality and age of data already gathered, the experience and breadth of expertise of the surveyors used to carry out new survey work, and the choice of recording techniques. Both active recording techniques (e.g. netting or observation) and passive trapping techniques can be employed. Where active methods are being employed across a broad taxonomic spectrum, it is wise to sample the invertebrate fauna on at least four periods, such as spring, early summer, late summer and early autumn. However, different insect groups require different timings and in some instances a single good mid summer visit may suffice for a group e.g. dragonflies.

Often several specialists are required to provide good taxonomic coverage. For example, in most of the surveys I have co-ordinated, I will tackle Diptera, aculeate Hymenoptera and various smaller orders, whilst a colleague will concentrate on Coleoptera, Hemiptera and various smaller orders. Sometimes an arachnologist is also drafted in. Each surveyor is left to choose the ideal dates for surveying providing they fall within any deadlines. Individual visits usually consist of about 5–6 hours in the field, but this depends heavily on the size and complexity of a site. On very large sites, it is sometimes necessary to double-up visits i.e. make two visits in the place of one to ensure that a site receives even coverage.

Clearly, repeat visits by teams of surveyors can have major cost implications, but it is sometimes possible to incorporate good local amateurs onto a survey team at lower rates than professionals. Local branches of societies and recording schemes such as Butterfly Conservation often keep detailed up-to-date information on the better sites in their patch and may be able to supply instantly usable data. Occasionally budgets and deadlines are so severe that one has to be satisfied with a single visit without any additional support. Under such circumstances, it is usually wise to concentrate on finding rare and unusual species within the groups you are most comfortable with, and assessing the distribution of their requirements rather than aiming for poor species lists across a broad taxonomic spectrum. If the level of recording has been inadequate due to constraints, this should always be clearly stated

in the results and non-technical summary, otherwise lack of impact can be falsely inferred from a lack of data.

The choice of survey techniques can be critical. Trapping techniques such as pitfall traps, malaise traps and water traps can be incorporated and are very useful for groups such as beetles and spiders. They can provide a firm basis for replicable sampling, are less weather-dependent than hunting techniques and can be run over longer periods at lower expense than hunting techniques (Lott & Eyre, 1996). However, for many actively flying groups such as Diptera, aculeate Hymenoptera and butterflies, there is no substitute for some of the valuable observational data that can be gathered through netting and direct observation. This information is easily transferred to the maps using symbols and target notes. Combining active and passive techniques can be very productive as they tend to complement one another.

Gall-formers and leaf-miners are also best tackled by active searching. Rearing is rarely an option due to deadlines, but could be employed where a potential planning application is several years away. It is unlikely such work will be undertaken on a professional basis however, unless the land-owner, developer or local planning authority is exceptionally well-disposed towards nature conservation. For further advice on surveying see Brooks (1993) and Eyre (1996a).

Case histories

The above approach has now been used in 10 projects and has received favourable comment from planners, environmental consultancies, English Nature, the Environment Agency, wildlife trusts and other local authority ecologists. Two case histories are provided to demonstrate how important decisions were influenced by its usage.

1. **Herald Way Marsh SSSI, Coventry**

This post-industrial site, which was notified on the basis of its remarkable assemblage of scarce insects, was subject of a planning application by Coventry City Council, which proposed industrial development on the drier two-thirds of the site to leave a small marshy area which would be treated as a nature reserve. The first draft of the Environmental Assessment suggested that this would have minimal impact on the scarcer insects present, most of which were purported to be wetland species. Both English Nature and I (in my capacity as the council's Ecologist) were unhappy with this conclusion, suspecting a high proportion of the scarce species to be actually associated with the drier areas or dependent on both dry and wet parts of the site. I was commissioned to carry out an extensive survey during the spring and summer of 1994 and produced Individual Species Impact Sheets for 63 Red Data Book, Nationally Scarce and Regionally Scarce species. Impact magnitude was evaluated for these, which revealed that 28 would be substantially impacted and 9 would be moderately impacted (Falk & Lane, 1994). English Nature, which had been seeking a compromise prior to this, decided the partial development of the site would have an unacceptable impact on the integrity of the SSSI and decided to object outright. The City Council withdrew its application and has now agreed to work towards setting up a Local Nature Reserve here.

2. **River Cole Flood Alleviation Scheme, Warwickshire**

An Environmental Appraisal was commissioned by the Environment Agency in 1996 to examine the likely impacts of diverting a 1 km section of the River Cole to reduce the risk of serious flooding to parts of Coleshill. The river itself had some

quite interesting features such as shingle banks and slumping river banks, but the surrounding habitat was mostly improved pasture with a few wet depressions. Two full-day visits were made by a colleague and myself and special attention was given to insect assemblages associated with the river margins and the wet pasture. 376 species were recorded with individual impact sheets required for 20 scarcer ones (Falk & Lane, 1996). The shingle banks and river banks proved to be the most important features and would be severely impacted by the scheme. However, it was apparent that other shingle banks and slumping banks were present outside the zone of impact. It was recommended that the new river course should be designed to a specification that would allow new shingle banks and other useful riparian features to develop naturally in the hope that the scarce species being impacted would re-colonize these features from other stretches of the river. It was also recommended that the new river course should avoid the wet parts of the pasture and that the original river course not be completely filled in with spoil from the new stretch but developed into a linear water body that incorporated one of the original river banks and its associated plants and insects. The Environment Agency are amenable to all of these suggestions and if they are implemented it will result in considerable conservation gain to what is currently a rather dull stretch of floodplain.

Summary

Individual Species Impact Assessment Sheets are a pragmatic, explicit, flexible map-based technique for predicting the nature and severity of impact associated with a development proposal on a potentially important invertebrate site. They are designed specifically for use in Environment Assessments and Environmental Appraisals (in the formal planning sense), where a broad taxonomic spectrum of invertebrates is being considered. They are not designed for situations where a single highly endangered species is the subject of special scrutiny. Nor are they designed for 'environmental assessment' in the informal, non-planning sense, which tends to be concerned with site evaluation and comparison (using ISR Scores (Ball, 1986) and similar systems), rather than predicting impact at a single threatened site.

Their production requires the employment of sufficiently knowledgeable invertebrate specialists, but also encourages these specialists to present their information in a clear and accountable manner. Spurious data can more easily be identified and corrected, and impact can be described more easily in a non-technical fashion. This is no less than we should expect in Environmental Assessment work and the two case histories provided demonstrate that it can be a powerful tool in site defence or obtaining conservation gain. I would encourage fellow entomologists involved in Environmental Assessment and Appraisal work to test it out and I would welcome any feedback. It will also be interesting to see how the technique stands up in a planning enquiry when pitched against more traditional approaches. In theory it should be very robust if sufficient sampling was used.

The technique, which was briefly described in Falk, 1996, has received criticism by Eyre (1996b) on a number of criteria, such as its weather dependency, the lack of suitable experts nationally, cost implications and the perceived lack of enthusiasm for it by local authorities and developers in the north of Britain. Whilst I agree that these can all be constraints, they are invalid excuses for not employing it or encouraging its usage where the opportunity arises. The number of good entomologists directly involved in nature conservation is clearly growing and recent guidance by the IEA (1995), English Nature (1994) and Royal Society for the

Protection of Birds (1995) positively encourage the inclusion of broad-spectrum invertebrate surveys in Environmental Assessments. The planning system is becoming increasingly concerned with 'biodiversity' and 'sustainability' which is resulting in growing opportunities for invertebrate-related studies in site assessment and site management.

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